recited in claim 3 is operatively coupled to the dispersion compensating element not the variable optical attenuator. The inadvertent typographical error that led to the drawing objection as well as the 112, paragraph 2 rejection has been corrected with an appropriate amendment to claim 3. In view of this amendment, applicants respectfully request reconsideration and withdrawal of the drawing objection and the 112, paragraph 2 rejection.

Art Rejections

Claim 1 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Kinoshita. Claims 2-17 and 19-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kinoshita in view of Yang. Claims 18 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Kinoshita in view of Yang and Sugaya. These rejections, insofar as they pertain to the presently pending claims, are respectfully traversed.

According to the Office Action, Kinoshita teaches "all of the components of the invention but does not connect them in the exact order claimed." Relying on Fig. 4, the Office Action further states that it would be obvious to move (a) the DCF and (b) second EDF (erbium doped fiber) to a position prior to the VOA (VAT in the drawing).

The Office Action further states that it would have been obvious to rearrange the dispersion compensator (DC) relative to the other components "assuming the system is such that the power input into the DC is not so high as to cause damage." This assumption strikes at the heart of Kinoshita who specifically states that "The variable optical attenuator (VAT) reduces the input power to the DCF to below the allowed maximum." Thus, a primary purpose of the Kinoshita variable optical attenuator is to prevent damage to the DCF which necessarily requires that the VOA be located upstream of the DCF in order to reduce the input power being supplied to the DCF. The design illustrated by Kinoshita, therefore, requires the VOA to be located between the first and second amp stages.

In contrast, claim 1 specifically requires that the VOA be located downstream of the DCF, not upstream. Indeed, the claimed dispersion compensating element is connected between the first and second segments of active optical fiber while the claimed variable optical attenuator is connected between the second and third segments of active optical fiber which necessarily requires that the variable optical attenuator to be located downstream of the dispersion compensating element, not upstream as clearly required by Kinoshita.

Furthermore, one of ordinary skill in the art would not have found it obvious to change the positions of these elements given Kinoshita's explicit statement about preventing damage to the DCF by attenuating the signal with an upstream VOA. A downstream VOA, as recited in the claims, is totally opposite to this stated purpose. Kinoshita's statement concerning protecting the DC with a properly tuned VOA would motivate one of ordinary skill in the art to keep this arrangement intact and not move the VOA to another position as suggested by the Office Action.

Kinoshita's VOA is also used for a different purpose than the claimed invention thereby further leading one of ordinary skill in the art away from the claimed invention. As stated on page 85, second column of Kinoshita, his VOA is used to achieve automatic level control (ALC) despite variations in span loss and DC loss caused by changes in the number of channels being transmitted through the amp. This purpose is further summarized by Kinoshita as follows"

> "… the combination of gain-clamped EDFs and passive optical gain equalizers (GEQs) provides a spectrally-flattened gain over a wide range of input power. However, in this combination, the total output power varies with the input power, which means there is no ALC function. We therefore introduce a variable

> optical attenuator to overcome this problem." Page 83, second column.

Kinoshita's purpose is to compensate for the addition/subtraction of WDM channels being input to the amplifier: the attenuation of the VAT is controlled to achieve auto level control (ALC) such that channel number increases will cause a corresponding increase in VAT attenuation and vice versa. The EDF sections of Kinoshita utilize AGC (auto gain control) that, in combination with the ALC VAT, achieves AGC even when the number of channels being input to the Kinoshita amp changes.

In contrast, the purpose of the present invention is to flatten the gain of the amplifier using the VOA while keeping noise to a minimum. In terms of claim 1 this purpose is stated as "said variable optical attenuator attenuating the plurality of optical signals in response to the attenuation control signal **such that a gain profile of the plurality of dispersion compensated optical signals output from the second end portion of said third segment of active optical fiber is flattened.**"

The simple fact is that Kinoshita uses his VOA for a different and distinct purpose (ALC even during changes to the number of channels being amplified) that would lead one of ordinary skill in the art away from the claimed invention

instead of rendering the claimed invention obvious as alleged by the Office Action.

Furthermore, Kinoshita's design lumps the VOA and DCF together in the same location (between the 1st and 2cd amp stages). In contrast, the claimed amplifier does not lump the VOA and DCF together and, instead, places these elements in different locations in the optical circuit thereby distributing the loss throughout the amplifier. The loss distribution of the claimed amplifier has important and significant implications that further illustrate how the inventive concept and purpose differ from Kinoshita. By distributing the loss of the VOA and DCF across the claimed amplifier, the present invention achieves better noise performance as compared with Kinoshita.

To illustrate the advantages achieved by the invention with respect to Kinoshita, the two amplifiers were simulated as follows:

Test Conditions			Units
Wavelength Range	1535.82	1560.61	nm
Amplifier Gain	15	25	dB
Mid-stage Loss		12	dB
Number of channels		32	channels
Channel Spacing		100	GHz
Output Power per channel		7	dBm
Input Power per channel	-18	-8	dBm
Stage 1 980 nm Pump		110	mW
Stage 2 980 nm Pump		110	mW

Stage 3 1480 nm Pump		240	mW

Attachment 1 further illustrates this simulation including the amplifier configurations (comparing Kinoshita as shown in Fig. 1 with the amplifier recited in claim 1), test conditions (repeated above) over a range of wavelengths, amp gain values, and input powers per channel. The same GFF (gain flattening filter) was used in both simulations the profile of which is also shown in Attachment 1.

As can be seen in Attachment 1, the noise performance (measured in noise figure) of the Kinoshita (Fujitsu) amplifier is much worse than the CIENA amplifier. Remember, that noise figure is measured in decibels which is a logarithmic scale. Thus, the nearly 2dB difference in noise figure is a quite significant difference. Thus, distributing the losses as per the claimed invention translates into lower noise figure and, therefore, a wider dynamic range. Furthermore, a 2dB improvement in NF/OSNR is significant, because it will translate into 2 dB longer transmission distance.

With respect to independent claim 19, the Office Action and the applied art fails to address several significant claimed features. First of all, Kinoshita fails to disclose or suggest

the claimed step of optically attenuating the dispersion compensated optical signals. While Kinoshita does include a VAT, the location of the VAT after the DC necessarily means that signals attenuated in the VAT are not dispersion compensated signals as required by claim 19.

Secondly, Kinoshita fails to disclose or suggest the step of controlling said optically attenuating step to optically attenuate the dispersion compensated optical signals according to the input optical power sensed by said sensing step and a dispersion compensating element loss value as further recited in claim 19. No such control exists in Kinoshita particularly because the signal being attenuated in Kinoshita is not a dispersion compensated signal as required by claim 19.

Third, Kinoshita's purpose for optically attenuating is to achieve ALC even when the number of WDM channels increases/decreases. Thus, Kinoshita fails to disclose or suggest optically attenuating the plurality of dispersion compensated optical signals such that a gain profile of the plurality of dispersion compensated optical signals output from the third amplification stage is flattened as still further recited in claim 19.

Still further, neither Yang nor Sugaya remedy any of the noted deficiencies in Kinoshita. Indeed, Yang and Sugaya do not

disclose or suggest a VOA or any of the VOA control methods disclosed and claimed in the present application. Yang is merely applied to teach a memory device storing a reference value for optical input power. Sugaya is merely applied to teach monitoring and controlling tilt. While applicants do not necessarily agree with the propriety of combining Kinoshita with either Sugaya or Yang or both or with the statements made in the Office Action regarding these patents, the features of independent claims 1 and 19 are sufficient to distinguish the claimed invention from the applied art and the dependent claims are considered patentable at least because of the combination of features recited in their respective independent claims.

For all of the above reasons, taken alone or in combination, applicants respectfully request reconsideration and withdrawal of the art rejections.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael R. Cammarata (Reg. No. 39,491) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 50-0308 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

By______________________

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE ABSTRACT OF THE DISCLOSURE:

The Abstract has been amended as follows:

--A three stage optical amplifier is disclosed having a substantially flat gain profile. The amplifier includes a variable optical attenuator [and dispersion compensating element] coupled between second and third stages of the amplifier <u>and a dispersion compensating element</u>. The attenuation of the optical attenuator is adjusted in accordance with the loss across dispersion compensating element and the optical power input to the amplifier to thereby obtain a substantially flattened gain profile. An offset value can also be used to refine the variable optical attenuator control <u>and minimize nonflatness</u>. The first and second stages are preferably pumped to provide high gain and a low noise figure and the third stage is preferably pumped to provide a high optical conversion efficiency. In an additional example, received optical powers associated with each of the channels in a WDM system are monitored and the attenuators within each amplifier in the system are controlled so that the received powers are substantially equal.--

IN THE SPECIFICATION:

Page 2, second full paragraph has been amended as follows:

-- Various improvements to such conventional amplifiers were patented by the assignee of the present invention. Particularly, U.S. Patents [5,057,959] 6,057,959; 5,963,361; 6,049,413; and 6,061,171 disclose and claim various gain-flattened optical amplifiers. These disclosed amplifiers utilize two-stage amplification in which two stages of Erbium-doped fiber are pumped and in which an inter-stage variable optical attenuator is controlled. Various types of variable optical attenuator control are disclosed including adjusting the attenuation according to the gain of the first and second stages or the ASE (amplified [stimulated] spontaneous emission) of the first and second stages.--

IN THE CLAIMS:

The claims of the invention has been amended as follows:

3. (Amended) The optical amplification device in accordance with claim 1, said control circuit including:

a first photodetector operatively coupled to the first end portion of said first segment of active optical fiber, said

photodetector sensing the input optical power of at least one of the plurality of optical signals input to the first end of said first segment of active optical fiber and outputting an electrical signal in response thereto;

a second photodetector operatively coupled to an input port of said [variable optical attenuator] <u>dispersion compensating element</u>, said second photodetector sensing an optical input power associated with the plurality of optical signals input to said dispersion compensating element and outputting a second electrical signal in response thereto;

a third photodetector operatively coupled to an output port of said dispersion compensating element, said third photodetector sensing an optical output power associated with the plurality of dispersion compensated optical signals output from said dispersion compensating element and outputting a third electrical signal in response thereto;

a memory device storing a reference span loss value indicative of a span loss associated with a preceding span to which said first segment of active optical fiber is operatively connected and a reference dispersion compensating element loss value representative of a reference power loss across said dispersion compensating element;

a processing unit operatively coupled to said first, second and third photodetectors and to said memory device, said processing unit receiving the first, second and third electrical signals from said first, second, and third photodetectors and the reference span loss and dispersion compensating element loss values from said memory device; said processing unit outputting the attenuation control signal in response to the first electrical signal, the second electrical signal, the third electrical signal, the reference span loss value and the dispersion compensating element loss value.